Title: **Global inter-comparison of 12 land surface heat flux estimates, *Journal of Geophysical Research* (American Geophysical Union)**

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Abstract:

A global inter-comparison of 12 monthly mean land surface heat flux products for the period 1993-1995 is presented. The inter-comparison includes some of the first emerging global dedicated products (developed at Paris Observatory, MPI for Biogeochemistry, University of California Berkeley, University of Maryland, and Princeton University) and examples of fluxes produced by reanalyses (ERA-Interim, MERRA, NCEP-DOE) and off-line forced land surface models (GSWP-2, GLDAS CLM/Mosaic/Noah). Inter-comparison of the global latent heat flux (Qle) annual means shows a spread of ~20 W m^{-2} (all-product global average of ~45 W m^{-2}). Approximately similar spread is observed for the sensible (Qh) and net radiative (Rn) fluxes. In general, the products correlate well with each other, helped by the large seasonal variability and common forcing data for some of the products. Expected spatial distributions related to the major climatic regimes and geographical features are reproduced by all products. Nevertheless, large Qle and Qh absolute differences are also observed. The fluxes were spatially averaged for 10 vegetation classes. The larger Qle differences were observed for the rain forest, but when normalized by mean fluxes the differences were comparable to other classes. In general, the correlations between Qle and Rn were higher for the dedicated products compared with the reanalyses and off-line models. The fluxes were also averaged for 10 selected basins. The seasonality was generally well captured by all products, but large differences in the flux partitioning were observed for some products and basins.

Popular Summary:

Evaporation of water from the land surface, either directly from the soil or from via transpiration through plants, is an important component of the global water and energy cycle that couples the land surface to the atmosphere. At the global scale, however, the process of evaporation cannot be measured directly and is still poorly understood. As a substitute for direct measurements, output from numerical models of the land and the atmosphere that rely on satellite observations of related geophysical fields can be used to estimate global land surface evaporation. Alternatively, direct observations of evaporation from sparsely distributed ground-based instruments can be interpolated and extrapolated to provide approximate global estimates of evaporation. Because of the associated phase change of water, evaporation can also be expressed as an equivalent energy flux, termed the "latent heat flux", which is measured in W m^{-2}.

In this paper, we compare twelve data products of global land surface evaporation for the period 1993-1995. The average of the latent heat flux (LH) across the twelve products, three years, and global land area is about ~45 W m^{-2}, with a spread of ~20 W m^{-2} across the twelve products. In general, the data products show similar spatial and temporal variations, helped by the large seasonal variability and common forcing data for some of the products. Expected spatial distributions related to the major climatic regimes and geographical features are reproduced by all products. Nevertheless, large absolute differences in LH are observed. The fluxes were spatially averaged for 10 vegetation classes. The largest LH differences were observed for the rain forest, but when normalized by the mean fluxes the LH differences were comparable across vegetation classes. The LH fluxes were also averaged for 10 selected large river basins. The seasonality was generally well captured by all products.